



**Final Year Examination of the  
Three -Year Degree Course, 2001**

(Faculty of Science)

**PHYSICS**

(Atomic and Nuclear Physics)

Paper-I

Time : 3 Hours

Maximum Marks : 50

The candidates are requested to attempt **FIVE** questions in all taking at least **ONE** question from each unit.

All questions carry equal marks.

**UNIT-I**

1. (a) Discuss early views on atomic structure with reference to Thomson and Rutherford models. 2+3

(b) Derive the formula for the energy of an electron in the  $n$ th orbit of hydrogen atom according to the Bohr's model.

**OR**

2. (a) With the help of diagram explain the Franck and Hertz experiment. 6

(b) What are emission and absorption spectra? Give examples. 2+2

**UNIT-II**

3.(a) What are symmetric and antisymmetric wave-functions? What is their significance in defining the nature of particles? How do these lead to the Pauli exclusive principle? Explain. 2+2+2

(b) Explain why the X-ray spectra of elements of nearby atomic numbers are qualitatively very similar. What are Auger electrons?

2+2

**OR**

4. (a) Discuss the periodic table of elements. 5

(b) What are the possible orientations of the total angular moments  $J$  for  $j=3/2$  and  $l=1$ ? Give the spectroscopic symbols.

3+2

### UNIT-III

5. (a) Derive an expression for the rotational energy levels of a diatomic molecules about its centre of mass. 5

(b) A rotational transition  $L=-1$  to  $L=0$  for the molecule CO has a measured absorption wavelength 2.60 mm. Calculate the moment of inertia and bond length 'r' for the CO molecules. 2.5+2.5

**OR**

6. (a) Explain the mechanism of covalent bonding by giving suitable example. 4

(b) What gives rise to rotational, vibration and electronic bonds in a molecules? 2+2+2

### UNIT-IV

7. (a) Discuss the different terms in the Weizacker formula. 6

6

(b) What are the general characteristics of nuclear forces? 4

4

**OR**

8.(a) Define mean or average life of a radioactive atom. What is decay constant? Give the relation between mean-life and decay constant. 2+2+4

2+2+4

(b) What is meant by range  $\alpha$ -particles ? 2

2

## UNIT-V

9.(a) Describe a He-Ne laser. How is population inversion achieved in this type of laser? 7

(b) Give a few properties of a laser beam. 3

**OR**

10. (a) Explain the meaning of:

(i) Strangeness. 2

(ii) Isotopic spin. 2

(iii) Hyper charge. 2

Give examples.

(b) What are Antiparticles? Does the neutron have an antiparticle ? 3+1